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A simple scoring system to reduce the negative appendicectomy rate

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In a controlled, prospective study the following five criteria were used for the diagnosis and management of acute appendicitis: abdominal pain; vomiting; right lower quadrant tenderness; low grade fever (≤38.8°C); and polymorphonuclear leucocytosis (TC ≥ 10 000 with polymorphs ≥ 75%). The aim of the study was to reduce the negative appendicectomy rate. If four out of five or five out of five criteria were present on admission, appendicectomy was carried out. On the other hand, if three out of five criteria were present on admission, the patient was subjected to active inpatient observation until either the development of the fourth criterion, when appendicectomy was performed, or until the patient recovered and the condition did not progress beyond the third criterion. Generalised peritonitis due to a perforated appendix was excluded from the study.

Over a 1-year period, 58 patients (M:F = 45:13) were entered into the study. Appendicectomy was carried out in 46 (80%) of patients; of these, 32 patients (70%) were operated on soon after admission. The remaining 14 (30%) were operated on after a period of inpatient observation decided the development of the fourth criterion. A total of 12 patients (12/58 = 20%) did not undergo operation.

The control group consisted of 59 patients upon whom appendicectomy was carried out by another surgical unit over the same 1-year period. The negative appendicectomy rate in the trial group was 6.5% (3/46), whereas in the control group it was 17% (10/59) ($P < 0.05$). We conclude that the use of a simple scoring system can significantly reduce the negative appendicectomy rate.

Attempts are being made worldwide to reduce the negative appendicectomy rate *(1,2)*. It is now recognised that the 15–30% negative appendicectomy rate that surgeons have hitherto 'accepted' can no longer be justified *(1)*. The removal of a normal appendix carries a price—the usual spectrum of immediate postoperative complications in up to 15% of patients *(3)* and late complications such as intestinal obstruction *(4,5)*, incisional hernias *(6)*, and a three times greater chance of developing a right-sided inguinal hernia *(7)*. In women of child-bearing age, a negative appendicectomy may result in sterility from bilateral fimbrial adhesions to the operative site and wound *(8,9)*. A small proportion of patients may even die after a negative appendicectomy *(4,8)*.

Methods of securing an acceptably low negative appendicectomy rate have included computer-aided diagnosis *(10,11)*, ultrasonic imaging *(12,13)* and laparoscopy *(14)*; but all these need specialised equipment and/or expertise available 24 hours a day and are beset with technical and accuracy problems of their own *(1)*.

Intensive inhospital observation can significantly reduce the negative appendicectomy rate *(15,16)*, but there are no clear criteria for separating those who need immediate appendicectomy from those who need intensive observation, which is often prolonged.

Clinical scoring systems to aid diagnosis have been described for acute appendicitis *(17–20)*, but the cited studies are either computer-based or retrospective. One study *(17)* is prospective but does not have a concurrent control group and uses too many different attributes in the scoring *(19)*.

This study reports the results from the use of a simple scoring system incorporating five essentially clinical criteria in a controlled, prospective trial to reduce the negative appendicectomy rate.

Patients and methods

The study was on-going and prospective and carried out by one general surgical unit for a total period of 1 year from September 1988; a total of 58 patients were entered

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into the study. The management protocol was fully incorporated in the clinical assessment and routine of the junior registrars and house surgeons who participated in the study.

Another general surgical unit functioned as the control unit from the start of the study.

The following five criteria were used for the diagnosis of acute appendicitis:

1 Abdominal pain—defined for the study as abdominal pain (*not* right iliac fossa alone) occurring within 48 h of presentation.
2 Vomiting—one or more episodes.
3 Right lower quadrant tenderness (between-observer variation bias was eliminated by separate pilot study).
4 Low grade fever—defined for the study as fever ≤38.8°C.
5 Polymorphonuclear leucocytosis—defined for the study as a total count ≥10 000 with polymorphs ≥ 75%.

Any patient who had abdominal pain with any two of the other criteria was entered into the study. Thus, for example, a patient with abdominal pain, right lower quadrant tenderness and polymorphonuclear leucocytosis was entered into the study; so was a patient with abdominal pain, right lower quadrant tenderness and low grade fever.

Patients diagnosed as having general peritonitis were excluded from the study.

Any patient with four out of five or five out of five criteria present was operated on for appendicectomy forthwith.

On the other hand, if only three out of five criteria were present, the patient was started on an intravenous drip, allowed nothing by mouth and a process of active observation was started. No antibiotics were given. If the fourth criterion appeared, operation was undertaken immediately. But if, on the other hand, the condition did not progress beyond three criteria, active observation was continued until either the patient recovered or developed the fourth criterion. The management protocol is summarised in Fig. 1.

The appendix was considered inflamed if the operating surgeon recognised signs of inflammation during the operation and the pathologist confirmed acute appendicitis. Conversely, if the pathologist reported 'no evidence of acute inflammation' and/or if the surgeon did not recognise signs of acute inflammation in the organ, the case was designated a 'negative appendicectomy'. The whole length of the appendix was sectioned for histopathological study.

The results of this study were compared with a control group of patients upon whom appendicectomy was carried out by another surgical unit where these five criteria were not used for diagnosis. This unit performed 59 appendicectomies during the same 1-year period from September 1988, and by functioning as the 'control' unit was an active participant in the trial.

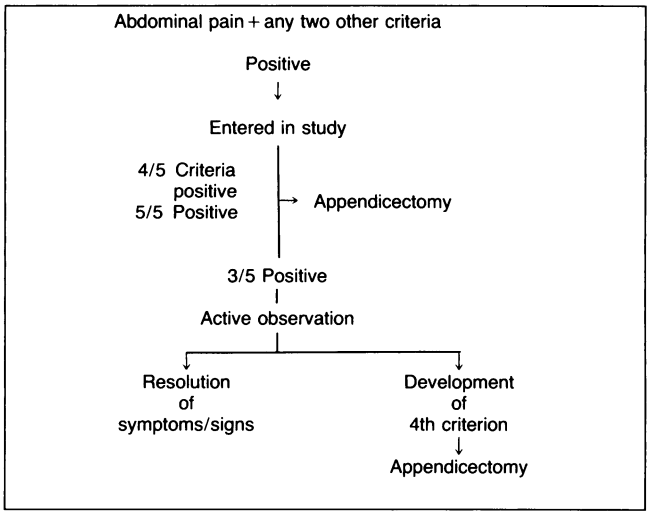

Figure 1

Statistical significance was tested by Fisher's exact probability test and a P value of <0.05 was considered significant.

Results

Male : female ratio and age distribution of patients

(*a*) Trial group (58): Mean age 24 years (range 10–56 years)
M : F = 45 : 13.
(*b*) Control group (59): Mean age 26 years (range 7–50 years)
M : F = 45 : 14.

Appendicectomies in trial group

Out of the 58 patients who were entered into the trial, 46 (80%) underwent an appendicectomy. Thus, 46 patients had 4/5 or 5/5 criteria present on admission or had 3/5 present on admission and developed the fourth criterion during a period of active inpatient observation. The remaining 12 patients in the study (20%) did not undergo operation. Average inpatient hospital stay in the latter group was 3 days (range 2–6 days).

Negative appendicectomy rates: trial and control groups

The control group's negative appendicectomy rate was 17%, whereas the trial group's negative appendicectomy rate was 6.5% ($P = 0.046 < 0.05$) (Table I).

Figure 2 shows the results. The control group's negative appendicectomy rate of 17% was somewhat lower than the hitherto 'accepted' figures, but significantly higher than the trial group's negative appendicectomy rate of 6.5%.

Table I. Negative appendicectomy rates: trial *vs* control group

	Negative appendicectomies	*Positive appendicectomies*	*Total*
Trial group	3 (6.5%)	43	46
Control group	10 (17%)	49	59

$P = 0.046$; Fisher's exact probability test

Subclassification of male and female subgroups

With a view to determining the negative appendicectomy rate in the female subgroup:

(*a*) *Trial group of 58; M:F = 45:13*
Nine out of 13 females underwent operation (69%). There was one negative appendicectomy (11%) (one out of 9).

(*b*) *Control group of 59; M:F = 45:14*

In the female subgroup of 14 there were three negative appendicectomies (21.4%), $P > 0.05$.

Effect of inpatient observation in trial group (Fig. 3)

Total number of patients, 58. Number of appendicectomies, 46.

Of these, 14 were operated after inpatient observation had determined the development of the fourth criterion (14/46 = 30%).

A total of 12 patients (12/58 = 20%) were discharged after inpatient observation. In these patients the condition did not progress beyond three criteria. None of the patients developed an appendix mass or generalised peritonitis from perforation.

Perforation recognised at operation* in the trial and control groups (Table II)

(*a*) *Trial group of 46*
Number of perforated appendices recognised at operation* 3 (6.5%).

(*b*) *Control group, 59*
Number of perforated appendices recognised at operation*, 8 (13.5%), $P > 0.05$

Findings in negative appendicectomy cases (at operation)

(*a*) Trial group: three negative appendicectomies
Nil (ANSAP) (2)
Ruptured (R) ovarian follicle (1)

* Peritonitis from a perforated appendix recognised preoperatively was excluded from the trial.

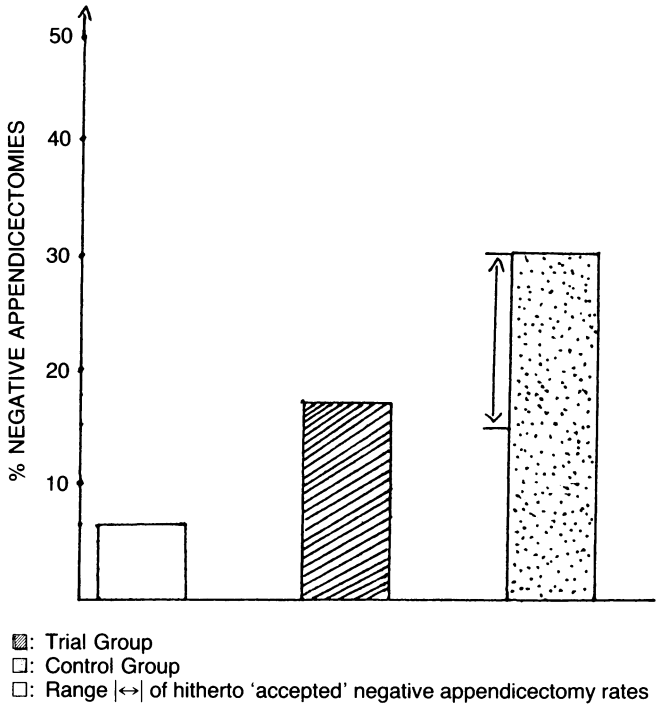

Figure 2. Negative appendicectomy rates.

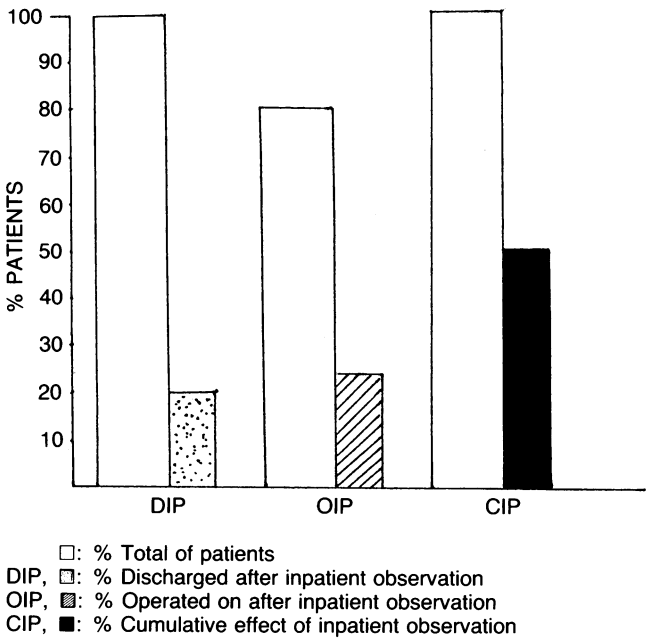

Figure 3. Effect of inpatient observation.

Table II. Perforations recognised at operation: trial *vs* control group

	Appendix found perforated	*Appendix found unperforated*	*Total*
Trial group	3 (6.5%)	43	46
Control group	8 (13.5%)	51	59

$P > 0.05$; Fisher's exact test

(*b*) Control group: 10 negative appendicectomies

Nil (ANSAP) (6)
Ruptured (R) ovarian follicle (2)
? Amoebic typhlitis (2)

Note: The syndrome of Acute Non-specific Abdominal pain (ANSAP) is well-recognised *(15,16)*, and cases where no abnormal pathology was discovered at operation were assigned to this group.

Discussion

Although it is more than 100 years since McBurney *(21)* described his "experience with early operative interference in cases of disease of the vermiform appendix", it is perhaps surprising that only recently *(1)* has attention been focused on the patient who, although not having inflamed appendix, is nevertheless subjected to surgery and unnecessary appendicectomy. Surgeons have believed it safer to remove a normal appendix than risk perforation if the organ is in fact inflamed. But this view has been challenged by studies *(16,22)* which showed that it is possible to reduce the negative appendicectomy rate significantly by intensive inhospital observation without at the same time increasing the perforation rate. Upwards of 40% of children *(16)* and adults *(15)* admitted to surgical units with acute abdominal pain recover spontaneously without treatment; this spontaneously recovering syndrome has acquired the name 'Acute Non-specific Abdominal Pain (ANSAP) *(2,15)*.

The simple five criteria score system that we have described for reducing the negative appendicectomy rate is clinically based, non-invasive, requires no special equipment and has been used successfully by house surgeons and junior registrars. The advantages of this scoring system over intensive inpatient observation alone are:

(*a*) A precise decision is made on admission as to exactly which patient needs immediate appendicectomy and which patient needs a period of observation.
(*b*) On repeated examination during the period of active inpatient observation, the doctor knows exactly what to look for; namely, the development of the fourth criterion.
(*c*) The organised numerical framework which this clinical scoring system employs, both for initial decision-making and for inpatient observation, sets the accent on precision and simplicity.

Because the diagnosis of a negative or a positive appendicectomy was made only in those who were taken up for surgery, the study may be criticised on the grounds that those discharged after active inpatient observation alone may, in fact, have had appendicitis which resolved spontaneously. But the patients assigned to active inpatient observation (3/5 criteria positive) were not started on any antibiotic and none of these patients developed either an appendix mass or generalised peritonitis. If some of them did have occult appendicitis, what is the chance that the condition will recur? Furthermore, is there a subgroup of patients with acute 'catarrhal' appendicitis who can be treated conservatively with success?

In answer to the first question, follow-up studies by other groups *(16,24)* have shown that only very rarely do patients return with florid appendicitis. The second question requires further large scale clinical trials to answer, but we suggest that if there is a subgroup of patients with non-obstructive (catarrhal) appendicitis which may be treated successfully without operation, the use of the five criteria can define and select such a subgroup.

Experienced surgeons can achieve a lower negative appendicectomy rate than can their more junior colleagues *(24,25)*; but both in the developed and in the developing world, it is the junior surgeon who performs the bulk of the emergency surgery of the acute abdomen. The five criteria scoring system can be confidently employed by junior surgeons and shows how diagnostic accuracy may be improved.

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Invited comment

The authors' aim is to reduce the number of patients having a 'negative appendicectomy' by means of a simple scoring system. They show that the system works well in their hands, and achieves its objectives. Its great advantage is simplicity, and any surgical team involved in emergencies could embark on 'validation' of this work by means of a duplicated sheet attached to the front of all arriving patients, starting on the day they read the paper. However, the imposition of a rigid system carries certain hazards, and modifications to the protocol might prove beneficial; of the five criteria chosen, the one entitled 'right lower quadrant tenderness' might be given a different valuation from the rest. By the authors' protocol, patients arriving without this feature, but with all other four features positive, will proceed to immediate appendicectomy. For some patients this might be undesirable. Alternatively, patients who have this feature, but lack two of the others, for example vomiting and a raised white count, will enter the 'appendicectomy withheld' group until such time as either of the missing features becomes positive. Again this might be undesirable. At the risk of sacrificing simplicity, a further study might increase the influence of right lower quadrant tenderness, for example by giving it a double or triple score and altering the totals accordingly. The authors do not mention a 'safety clause' by which patients may be taken out from the trial in either direction simply because a 'senior surgical opinion' is unhappy about the management decision produced by the protocol. Surgical registrars reading this paper, and the comments above, might well add their own modifications, and perhaps include a 'control group' produced by a method more acceptable to statisticians. Such projects would be worthwhile as 'in house research' and the best would doubtless find their way into print.

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